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THE VARIATIONS OF A BROOD OF WATERSNAKES.

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On June 22, 1914, I caught a female *Natrix sipedon*, in James River near Midway Mills, Nelson County, Virginia, about 40 miles below Lynchburg. The river all along here is swift and shallow. There are many low islands covered with heavy grass, where the snakes hide. The most common fish is the spotted catfish, *Ictalurus punctatus*, which has been introduced from the West, and these form the chief food of the snakes.

I kept the female in company with several others of her own species. She showed a larger appetite than any of the others, eating toads, frogs, tadpoles, and small fish, whenever any were offered to her. She shed her skin on July 10, and again on August 19. The other females with which she was confined gave birth to young as follows : two on August 19, and one on each of these dates, August 21, 24, 26, and September 3. This particular specimen, however, did not give birth till October 12.

I observed the birth of most of her brood. The mother crawled around the cage with her tail raised and every now and then she expelled from one to three eggs. The covering of these was transparent and the young could plainly be seen. They lay still for a few moments, then struggled to break the sac and thrust out the head. After accomplishing this, they lay quiet another minute, thrusting out the tongue, and then crawled off, at once becoming very lively. As soon as they dried off, they began to shed the skin. I could observe no egg-tooth in these young snakes.

Originally there were 37 live young, two nearly developed embryos, and one which did not succeed in bursting the egg sac, and so died. Seven, however, were eaten by a large bull-

frog, and one of the embryos was not sufficiently developed for the scutellation to be recorded, so that the number of specimens on which this study is based is 32 young and the mother. The total lengths of 22 killed on November 13 ranged between 167–200 mm.

Variable Characters.

The 32 young and the mother varied in the following characters: number of supralabials, infralabials, nasals, loreals, preoculars, plates in the second row of temporals, dorsal scale rows, ventral plates, subcaudal plates and unbroken color bands around the body.

Invariable are: the number of postoculars (3), the single plate in the first row of temporals, the divided anal, and the divided condition of the subcaudal plates.

Supralabials.—Nine or eight present. The change is caused by the splitting of the third plate counting from the front in specimens with eight. The mother had 9-8.

The young:	Formula.	No. of spec.	Per cent.
	9–8	3	9
	8–8	29	91

Nine	1	2	3	4	5	Eye	6	7	8	9	
Eight	1	2	4		5	Eye	6	7	8	9	

Infralabials.—Twelve to nine present. The change is caused by the splitting of the last or the fourth and after these two the penultimate divides giving twelve.

Twelve	1	2	3	4	5	6	Eye	7	8	9	10	11	12
Eleven	1	2	3	4	5	6	Eye	7	8	9	11		12
Nine	1	2	3	5		6	Eye	7	8	9	12		

The mother had 12–11.

The young:	Formula.	No. of spec.	Per cent.
	11–11	1	3.1
	11–10	5	15.6
	10–10	16	50.0
	10– 9	6	18.7
	9– 9	4	12.5

Nasals.—Where there were three present there was a small upper posterior nasal. Mother, 2–2.

The young:	Formula.	No. of spec.	Per cent.
	2–2	26	81.4
	2–3	3	9.3
	3–3	3	9.3

Loreals or Prefrontals.—Where two loreals were present the prefrontal was divided at the canthus rostralis. Mother, 2–2.

Young: Formula.	No. of spec.	Per cent.
2–2	10	31.2
2–1	2	6.2
1–1	20	62.5

Preoculars.—Where two were present the lower quarter of the normal plate was divided off. Mother, 1–1.

Young: Formula.	No. of Spec.	Per cent.
1–1	18	56.5
1–2	5	15.5
2–2	9	28

Second Row of Temporals.—Mother, 3–3.

Young: Formula.	No. of Spec.	Per cent.
4–3	2	6.2
3–3	25	77.5
3–2	3	9.3
2–2	2	6.2

Unbroken Color Bands.—These were the number of unbroken saddles around the body, which in this subspecies break up into three series of alternating spots on the posterior part of the body. The mother had eleven bands. The young ranged from 17–6. Mean 11.5. Average 10.5.

No. of bands:	17	16	15	14	12	11	10	9	8	7	6
No. of young:	1	1	2	1	2	8	6	5	5	1	1

Sub-caudal Plates.—The mother had 67 pairs. The young ranged from 61 to 80 pairs. Mean, 70.5; average, 66.5.

	Probably Females.							Probably Males.						
Sub-caudals	61	63	64	65	66	67	68	71	73	74	76	77	78	80
No. of young	1	4	3	4	3	4	2	1	1	1	2	2	1	2

Ventral Plates.—The mother had 134. The range of the young was from 130–140. Mean, 135; average, 136.5.

Ventrals	130	131	132	133	134	135	136	137	138	139	140
No. of Young	1	0	1	2	3	4	4	5	3	7	2

The first ventral was taken as the first undivided plate under the throat. I do not believe that a variation of more than 2 at the outside was thus admitted, whereas any other method would have been open to uncertainty, especially as the ventrals are the same color as the throat, and are unspotted till about the 25th.

Position of the Navel.—A point of interest in the consideration of the variation of the ventral series is the position of the navel. This ranges from the 116th to the 128th ventral. The distance between the navel

and the anus varies from 17–13 plates. Thus the distance between the navel and the first ventral varies 12 plates and between the navel and the anus varies 5 plates. The range of variation of the ventrals is 11 plates. These figures seem to indicate that whatever variation takes place in the ventral series, takes place anterior to the navel, which itself varies about 4 plates.

No. of ventrals between navel and anus	17	16	15	14	13
No. of spec.	2	7	9	8	4

Position of navel	116	117	118	119	120	121	122	123	124	125	127
No. of spec.	1	2	1	4	3	2	5	2	7	2	1

Dorsal Scale Rows.—The extremes of variation in this character shown by this series of specimens is 23–25–23–21–19 and 21–23–21–19–17.

The normal method of row dropping for this species seems to be 25—VI, 23—V, 21—VII, 19—IV. The variation in this character can be shown better in the following tables. One point, however, may be made now. In the mother the 19 rows are reduced by dropping the third row. Most of the young also drop the third row in reducing from 19–17, but this is not the usual method with others of this species, or with other species of this genus, a good many of which have been examined.

The 23 count is usually reduced just posterior to the gall bladder.

The Arabic numerals are used to indicate abnormal row-dropping, and show actual row dropped in count from belly at point dropped.

I. 23–25–23–21–19 (+VI—VI—V—VII)

Caudals	23+VI		25—VI		23—V		21—VII		19	Row dropped
	Rt.	Left			—4		—4			
64	26	33	54	59	82	89	114	113	Cont.	Ventral level

Intermediate. 23–25–23–21–19–18–19 (+VI—VI—V—VII—IV+IV)

(The mother)

C	23+VI		25—VI		23—V		21—VII		19—IV	18+IV	19
			—5				—4	—4	—3	+3	
67	37	39	60	70	87	86	101	108	—126	—128	Cont.

Intermediate. 23–25–23–21–19–17–18 (+VI—VI—V—VII—IV+IV)

C	23+VI		25—VI		23—V		21—VII		19—IV		17+IV	18
	+5	+5	—5		—4		—4		—5			
67	44	44	68	66	92	89	115	115	131	128	—130	Cont.

II. 23–25–23–21–19–17 (+VI—VI—V—VII—IV)

C	23+VI		25—VI		23—V		21—VII		19—IV		17
			—5				—4		—5		
68	36	52	41	58	84	85	106	102	132	133	Cont.

Intermediate. 22-23-25-23-21-19-17 (+V+VI—VI—V—VII—IV)

C	22+V	23+VI	25—VI	23—V	21—VII	19—IV	17
		+5					
67	— 19	42 46	53 55	80 85	111 109	133 130	Cont.
		+5	—5 —5	—4	—4	—3 —3	
66	— 16	42 39	42 41	79 80	104 105	128 126	Cont.

Intermediate. 23-24-23-21-19-17 (+VI—VI—V—VII—IV)

C	23+VI	24—VI	23—V	21—VII	19—IV	17 Cont.
		— 5	—4	—4	—3 —3	
65	— 42	— 48	79 78	90 100	124 117	"
			—4		—3 —3	
65	— 40	— 41	75 79	96 96	117 114	"
			—4	—4	—3 —3	
64	— 34	— 35	78 75	94 94	117 117	"
					—3 —3	
40+	— 51	— 53	82 81	101 104	127 120	"

Intermediate. 22-23-24-23-21-19-17 (+V+VI—VI—V—VII—IV)

C	22+V	23+VI	24—VI	23—V	21—VII	19—IV	17 Cont.
		+5	—5	—4	—4 —4	—3 —3	
80	24—	—57	—59	83 84	99 104	131 128	

Intermediate. 21-23-24-23-21-19-17 (+V+VI—VI—V—VII—IV)

C	21+V	23+VI	24—VI	23—V	21—VII	19—IV	17 Cont.
		+5			—4	—3 —3	
67	15 18	—43	—48	84 80	101 106	126 124	
						—3 —3	
66	15 16	—55	—55	75 77	96 99	123 120	
					—4	—3 —3	
63	18 19	—43	—48	76 76	94 93	124 119	

III. 23-21-19-17 (—V,—VII,—IV)

C	23—V	21—VII	19—IV	17 Cont.
			—3 —3	
78	83 84	99 99	130 125	
	—4			
74	80 80	100 98	122 122	
	—4		—3	
65	80 81	97 104	127 128	
64	84 82	100 103	126 128	
	—4		—3 —3	
63	80 85	101 102	132 131	

Intermediate. 22-23-21-19-17 (+V—V—VII—IV)

C	22+V	23—V	21—VII	19—IV	17 Cont.
		—4		—3	
71	—20	76 77	99 97	122 120	
		—4	—4	—3	
63	—20	80 78	100 103	126 122	

IV. 21-23-21-19-17 (+V—V—VII—IV)

C	21+V	23—V	21—VII	19—IV	17 Cont.
	+4	—4	—4		
80	18 20	77 79	91 99	127 124	
			—4	—3 —3	
77	14 13	81 79	96 98	128 124	
		—4 —4		—3 —3	
77	?	83 83	98 99	130 128	
	+4	—4	—4		
76	17 20	80 83	99 99	130 128	
	+6			—3 —3	
76	16 22	78 79	91 96	125 123	
				—3	
73	21 22	77 80	94 102	126 128	
		—4	—4	—3	
68	20 18	79 82	101 103	129 129	
				—3	
67	19 17	72 74	94 97	121 118	
			—4	—3 —3	
66	12 14	79 77	99 104	125 123	
				—3	
65	24 24	77 76	96 97	122 121	
				—3 —3	
63	18 18	83 81	99 100	126 124	
			—4	—3	
61	26 21	70 75	88 90	123 115	

It is perhaps worthy of note that the left side seems to be somewhat higher in number of scale rows than the right. This is especially noticeable in bilaterally assymetrical specimens. Possibly this may be correlated with the assymetry of the lungs, the left being usually the only functional one. A summary of the variations in dorsal scale rows follows:

	No. Rows	♀	♂	%
I.	23-25-23-21-19	1	—	3
II.	23-25-23-21-19-17	1	—	3
(IIa.	21-23-25-23-21-19-17)	none	none	none
III.	23-21-19-17	3	2	15.5
IV.	21-23-21-19-17	6	6	37.5
	Intermediate (bilaterally assymetrical)	10	2	40.6
	" between I and II (mother)	1	—	—
	" " II and IIa	2	—	6
	" " IIa and IV	3	—	9
	" " II and III	4	—	12
	" " II and IV	—	1	3
	" " III and IV	1	1	6

SUMMARY OF VARIATIONS (— indicates normal).

C	V	Scale Rows	Preoc.	2d Row Temp.	Supra Labials	Infra Labials	Loreal	Nasal	Bands	Navel
64	135	23–25–23–21–19	—	—	—	9	—	—	8	119
*67	134	23–25–23–21–19–18–19	—	—	9–8	12–11	2	—	11	
67	138	23–25–23–21–19–17–18	—	—	—	—	—	—	9	124
68	137	23–25–23–21–19–17	—	—	—	—	—	—	8	
67	138	"	2–1	2–3	—	—	—	—	10	122–123
66	140	"	1–2	—	—	—	—	—	11	125
65	133	23–24–23–21–19–17	2	—	9–8	10–9	—	—	10	117
65	130	"	—	—	—	—	—	—	11	116–117
64	132	"	—	—	—	—	—	—	10	118
40+	134	"	—	—	—	10–11	—	—	11	120–121
80	139	22–23–24–23–21–19–17	1–2	3–4	—	10–9	—	—	6	125–126
67	139	21–23–24–23–21–19–17	—	—	—	9	—	—	9	122
66	135	"	—	—	—	—	—	—	9	121–122
63	136	"	—	2–3	—	11–10	—	—	11	119–120
78	137	23–21–19–17	—	—	—	—	2	—	17	124–125
74	133	"	2	—	—	9–10	2	3–2	11	117–118
65	137	"	—	—	—	—	—	—	11	
64	139	"	—	—	—	11–10	—	—	9	124
63	139	"	2	—	—	—	2	3	9	123
71	135	22–23–21–19–17	2	2	9–8	9	2–1	—	14	122–123
63	136	"	—	—	—	11–10	—	—	8	120
80	139	21–23–21–19–17	—	3–4	—	9	—	—	7	124
77	139	"	2–1	—	—	—	2	—	11	124
77	136	"	2	—	—	10–9	2	3	12	123–124
76	140	"	2	—	—	9–10	2	3	15	127–128
76	137	"	—	2–3	—	10–11	2	—	11	122–123
73	138	"	—	—	—	10–9	2	—	12	124
68	136	"	—	—	8–9	11	2–1	—	8	121–122
67	134	"	1–2	—	—	—	—	—	10	120
66	139	"	—	—	—	—	—	—	10	124
65	135	"	2	2	—	—	2	3–2	16	119
63	134	"	2	—	—	—	—	3–2	10	119
61	137	"	2	—	—	—	2	—	8	122
		Normal seems to be	1	3	8	10	1	2		

* Mother.

Correlations.—The most obvious correlation appears to be the phenomenon of a high number of subcaudals (i. e., the male sex) and a low scale formula.

A double loreal appears to accompany a low scale formula also, and a triple nasal very rarely appears in the absence of the double loreal. No other correlations are evident.

Conclusions.—These are chiefly conspicuous by their absence, but the young appear to inherit from the mother: (*a*) the decided abnormality of a double loreal; (*b*) the reducing of 19 to 17 by dropping the third row. The averages of ventrals, sub-caudals, and color bands are quite close to the mother's formula. They show a smaller number of dorsal scale rows, and a smaller labial formula.